Semester II

Unit I

Topic - Curriculum Reforms in Science Education

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In 2014, the central government formed a committee to draft new National Educational Policy.

TEACHING OF SCIENCE AS RECOMMENDED IN NATIONAL CURRICULUM FRAMEWORK 2005

Until 1976, Indian constitution allowed state governments to take decisions on matters related to education and centre could only provide suggestions on policy issues. At the same time, the National Education Policy (1968) entrusted NCERT to develop Curriculum Framework and accordingly National Curriculum Framework-1975 was developed. In the year 1976, constitution amended to include education in concurrent list and as a result, for the first time, the country could evolve a National Policy on Education in 1986. NCERT was entrusted to develop curriculum framework. It was recommended that the curriculum should have a core component to be followed across the country. Thereafter, National Curriculum Framework for School Education (1988), Learning without Burden (1993) recommended various suggestions to improve school education. NCERT developed new National Curriculum Framework in the year 2005.

. The relation between 'nature of science' and technology help us in formulating the 'vision of science education'. According to NCF-2005, good science education is one that is true to learner, true to life and true to science. Thus science education is intended to meet following criteria (validity) and science curriculum should adhere to it.

- **Cognitive validity** requires that the content, process, language and pedagogical practices of the curriculum are age appropriate, and within the cognitive reach of the learner (NCF-2005). For example, the basic concepts 70 Understanding Science of electromagnetic induction have to be taught before introducing the electric generator.

• **Content validity** requires that the curriculum must convey significant and correct scientific and correct information. Simplification of content, which is necessary for adapting the curriculum to the cognitive level of the learner, must not be so trivialised as to convey something basically flawed and/or meaningless(NCF-2005). What does it mean? The content transacted in the curriculum should be significant and scientifically accurate. We teach periodic table to learners just as an arrangement of elements. But it is meaningless until you expose learners to the scientific basis of ordering elements based on the atomic number (number of protons), electron configuration, chemical properties, etc. Many more logical factors contribute to the arrangement of elements in the periodic table and that must be convinced.

• **Process validity** requires that the curriculum should engage learners in acquiring the methods and processes that lead to the generation and validation of scientific knowledge and nurture the natural curiosity and creativity of the learner in science. Process validity is an important criterion since it helps the learner in 'leaning to learn' science (NCF-2005). The curriculum should engage learners in activities and experiments focusing the theory "learning to learn" and thereby developing the cognitive skills, curiosity, creativity and scientific knowledge. For example, chemical reaction is a topic to be taught by demonstrating. At the same time learners need opportunities to experience it. Thus the processes in science must be demonstrated and experimented.

• **Historical validity** requires that the science curriculum be informed by a historical perspective, enabling the learner to appreciate how the concepts of science evolve over time. It also helps the learner to view science as a social enterprise and to understand how social factors influence the development of science (NCF-2005). The knowledge that, science and scientific knowledge has historical evidence regarding its development and curriculum

should emphasise it. The efforts of scientists must be appreciated by learners and they themselves have to emerge as scientists. For example, while you teach different branches of science, you may explain the history behind it.

• **Environmental validity** requires that science be placed in the wider context of the learner's environment, local and global, enabling him/her to appreciate, the issues at the interface of science, technology and society, and equipping him/her with the requisite knowledge and skills to enter the world of work (NCF-2005). Science, technology and society are closely interrelated. The growth and progress of science and technology should benefit each other. The curricular learning experiences should relate to learners environment. For example, learners study the concept of 'cell' but they are less concerned about faulty batteries. People throw away obsolete batteries which has harmful effects to both environment and human life as it contains harmful chemicals. Thus, while teaching science the interrelationship among various components must be taught.

• **Ethical validity** requires that the curriculum promote the values of honesty, Science in School Curriculum objectivity, cooperation, and freedom from fear and prejudice, and inculcate in the learner a concern for life and preservation of the environment (NCF2005). For example while teaching the concept 'nuclear bomb'; teachers must be able to develop qualities like empathy, sympathy, etc. in learners. Science Curriculum at Different Stages: While developing the curriculum of various stages; the factors such as 'general aims and objectives of science education', content, pedagogical practices and mode of assessment must be considered. Development of Inventiveness and Creativity: One of the major objectives of teaching science is to develop among the learners the spirit of inquiry and creativity. Hence, **NCF-2005 recommends the following;**

• Engage learners in learning activities, science fairs, experiments and project-work, learners' science congress, co-curricular activities etc. to promote curiosity, inquisitiveness and creativity.

• Organise science and technology fairs at local, district, state and national level with coordinated effort of national and state level agencies, nongovernmental organisations and teacher associations.

• Develop experimental and technological modules along with text books and develop internal assessment mechanisms for evaluation. Textbooks: Textbooks are the core medium of transacting curriculum and thus the following points must be taken into consideration;

Promote extensive use of textbooks among learners and teachers. This also calls for universalisation of science education.

• Incorporate diverse learning activities in the textbooks. The field experiences of teachers must be considered while writing textbooks. Also ensure the participation of teachers, state and national agencies during preparation of textbooks.

Examination System:

- Learners are to be assessed at various stages of learning to ensure the attainment of educational objectives. The following **assessment reforms are recommended in the NCF-2005;**

• Internal assessment must be practised for experiments, learning activities and technological modules even for secondary and senior secondary board examinations.

• The theoretical examination should include questions to test critical understanding, experimental skills, enquiry procedures and competency to solve problems.

• To reduce stress, learners must have freedom to attend examinations at their own choice and time and the credits could be accumulated. Teacher Empowerment: The future teachers are

trained and shaped at the teacher education institutions. The quality of learner-teachers depends on the quality of teachers by whom they are trained. In such a scenario, the following are recommended for teacher education institutions

• The teacher training practices requires a complete overhaul in training programme, pedagogic practices, curriculum and training of science teachers. Future science teachers must be oriented and given training in skills and competencies in science teaching.

• Teachers who have school teaching experience must be appointed as science teacher educators. Recruitment modalities must be modified to appoint qualified teachers.

• Qualified and trained teachers must be attracted and appointed at various levels of schooling. Academic autonomy could be provided to maintain the quality of teaching.

• Implement measures to practice peer interaction among teachers and exchange of teachers within and outside schools may be promoted.

• Discourage the practice of entrusting teachers with extracurricular duties, reward and honour best practising teachers with incentives and promotional schemes. Equity: The disparity among poor and rich, caste inequalities, regional indifferences, etc. hinders the economic and cultural development. Each school subject should prepare learners fight against such anomalies. The following are suggested to maintain the equality and removal of discrepancies;

• Use science education as an instrument to build awareness and removal of caste issues, religious problems, gender divide, etc. This removes social – economic divide and bring in social transformation among people.

• Even though curriculum is context focused, it should provide scope to respect individual and diverse life styles.

• Implement suitable measures to sensitise teachers for a gender fair science education, both at pre-service and in-service stages.

• Use of ICT as a medium to promote science education and to reach the weaker and rural sections of the society thereby eliminating social divide of deprivation of education.